#11 11/27/02

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re application of

Akihiro GOTO , et al.

Docket No: Q65416

Appln. No.: 09/937,220

Group Art Unit: 1725

Confirmation No.: 6650

Examiner: Geoffrey S. EVANS

Filed: September 24, 2001

For: ELECTRIC POWER UNIT FOR ELECTRIC DISCHARGE SURFACE TREATMENT AND METHOD OF ELECTRIC DISCHARGE SURFACE TREATMENT

APPELLANTS' BRIEF ON APPEAL UNDER 37 C.F.R. § 1.192

Commissioner for Patents
Washington, D.C. 20231

Sir:

In accordance with the provisions of 37 C.F.R. § 1.192, Appellant submits the following:

I. REAL PARTY IN INTEREST

The real party in interest is MITSUBISHI DENKI KABUSHIKI KAISHA by virtue of an assignment executed by Akihiro GOTO and Toshio MORO (Appellant, hereafter), on July 6, 2001, and recorded by the Assignment Branch of the U.S. Patent and Trademark Office on September 24, 2001 (at Reel 012364, Frame 0193).

II. RELATED APPEALS AND INTERFERENCES

To the knowledge and belief of Appellant, the Assignee, and the undersigned, there are no other appeals or interferences before the Board of Appeals and Interferences that will directly affect or be affected by the Board's decision in the instant Appeal.

III. STATUS OF CLAIMS

Claims 1-3 are currently pending in the application. Claims 1-3 stand finally rejected under 35 U.S.C. § 102(b) as being anticipated by Magara (U.S. Patent No. 5,434,380) and under 35 U.S.C. § 103(a) as being obvious over Magara in view of Graell (U.S. Patent No. 5,187,341).

IV. STATUS OF AMENDMENTS

In response to the non-final first Office Action (Paper No. 4), Appellant filed an Amendment under 37 C.F.R. § 1.111 on February 11, 2002, containing amendments to claims 1 and 2 and adding new claim 3.

In response to the final Office Action (Paper No. 6), Appellant filed a Request for Reconsideration after Final Rejection on August 20, 2002.

In an Advisory Action (Paper 9), the Examiner stated that the Request for Reconsideration has been considered but did not overcome the rejection.

In response to the Advisory Action, Appellant filed a Notice of Appeal on September 23, 2002.

The Appendix included with this Brief, setting forth the claims involved in the appeal, reflects all of the claim changes in the above-identified (entered) Amendments.

V. SUMMARY OF THE INVENTION

The present invention relates to an electric power unit and a method of electric discharge surface treatment. In particular, this invention relates to an electric discharge surface treatment

by which a hard coat is formed on a surface of a workpiece when the electric discharge is generated between the electrode and the workpiece.

The electric power unit of this invention has a control means that divides an electric discharge current pulse into a first pulse width with a first peak value, a second pulse width with a second peak value, . . . , and an n-th pulse width with an n-th peak value (n is an integer equal to 2 or more). The control means sets the first pulse width and the first peak value so that an electric current density between the electrodes can be in a predetermined range to suppress emission of electrode material, and so that during a period of the first pulse width a diameter of an electric discharge arc column is extended. Also, the control means sets the k-th pulse width and the k-th peak value ($2 \leq k \leq n$, k is an integer) so that a quantity of supply of hard coat material by the emission of electrode material can be a predetermined value determined according to a predetermined processing condition.

The drawings are very helpful in understanding this invention. Figs. 1B and 1C show the electric discharge pulse, while Figs. 2A-2C illustrate the formation of a hard coat on the workpiece. As shown in Figs. 1B and 1C, the first pulse width T1 and the first peak value Ip1 are set by the control means 14 so that the electric current density can be in a predetermined range to suppress the emission of electrode material (Fig. 2A). The diameter of the electric discharge arc column 10 is then sufficiently extended in the range of the first pulse width T1 (Fig. 2B). Following the first pulse width, under the condition that the diameter of the electric discharge arc column 10 is extended, the control means 14 sets the next pulse width and the peak value so that a quantity of supply of hard coat material by the emission of electrode material can

be a predetermined value according to a predetermined processing condition in the following pulse width, and the electric discharge current is increased to the next predetermined peak value. In this way, the hard coat 17 can be effectively formed on the workpiece 2, as shown in Fig. 2C.

VI. ISSUES

The issue on appeal is as follows:

1. Whether claims 1-3 stand properly rejected under 35 U.S.C. § 102(b) as being anticipated by Magara; and

2. Whether claims 1-3 stand properly rejected under 35 U.S.C. § 103 (a) as being obvious over Magara in view of Graell.

VII. GROUPING OF CLAIMS

For purpose of the present appeal, with respect to the rejections under 35 U.S.C. § 102(a) and 103(a), each rejected claim 1-3 is considered patentably.

VIII. ARGUMENTS

Appellant respectfully requests the members of the Board to reverse the aforementioned rejections under 35 U.S.C. §§102 and 103.

1. The rejection of claims 1-3 under 35 U.S.C. § 102(b) as being anticipated by Magara.

Magara discloses an electric discharge machining apparatus having a high-voltage superposition circuit that includes current limiting resistors R1 and R2, and transistors TR1 and

TR2. During machining, an auxiliary power supply 10b supplies a high voltage to a machining gap 7 when transistor TR1 is switched ON, and thereafter transistor TR2 is switched ON to cause a main power supply 10a to supply a current of low energy.

The Examiner contended, on page 4 of the final Office Action, that Magara teaches that emission of the electrode material is suppressed during the first pulse width because during the first pulse width as contrasted with the second pulse width less emission of the electrode occurs. In addition, the Examiner also contended that the increase of the diameter of the electric discharge arc column during the first part of a discharge is inherent and merely a law of nature. In order to support his position, the Examiner cited an article "The BASICS: Technological Aspect of Spark Erosion."

Contrary to the Examiner's statement in the final Office Action, while Magara teaches a step-up current impulse diagram shown in Fig. 16(b), nowhere in the Magara patent is it taught or suggested that the pulse width and the peak value are controlled in a stepwise manner so that the quantity of supply of hard coat material by emission of electrode material is also controlled. In other words, according to the present invention, the control means sets the first pulse width and the first peak value such that the electric density between the electrodes can be in a predetermined range to suppress emission of electrode material. To this end, the increase of a diameter of the electric discharge arc column is controlled, with the result that the diameter of the electric discharge arc column is extended in the range of the first pulse width.

By way of contrast, the instant independent claims 1 and 2 specifically require that "the control means sets/(the step of) setting the first pulse width and the first peak value so that an

electric current density between the electrodes can be in a predetermined range to suppress emission of electrode material, and so that during a period of the first pulse width a diameter of an electric discharge arc column is extended." The above features are not taught by Magara. On the other hand, in Magara an electric current density between the electrodes is not controlled by setting the first pulse width and the first peak value to suppress emission of electrode material. Nor is the diameter of the electric discharge arc column current controlled. Even though the increase of the diameter of the electric discharge arc column during the first part of the discharge may naturally occur during that period, the Magara apparatus does not control the diameter or the electric current density between the electrodes by setting the first pulse width and the first peak value in the first place.

With respect to claim 3, claim 3 positively claims that the amount of electrode erosion is intentionally increased to promote the appropriate release of coat-formation elements into the gap, following the initial suppression period. The Magara patent clearly does not envision such a methodology. Specifically, the Magara patent does not disclose the step of "setting the k-th pulse width and the k-th peak value ($2 \leq k \leq n$, k is an integer) so that an amount of hard coat material supplied to a space between the electrode and the workpiece is increased to a predetermined appropriate quantity for formation of said hard coat," as called for in claim 3. Nor does it disclose the step of "setting the first pulse width and the first peak value so that an electric current density between the electrodes can be in a predetermined range to suppress emission of electrode material," as also required by claim 3.

Further, Magara discloses that an auxiliary power supply and a main power supply of a high voltage are changed over by electric discharge generation. The purpose of using the auxiliary power supply is to allow electric discharge to be easily generated by applying high voltage between electrodes, and the auxiliary power supply changes over to the main power supply rapidly after electric discharge has been generated. Accordingly, Magara fails to teach a technical concept that the length of a current pulse that flows from the auxiliary power supply is controlled. On the outer hand, an object of the invention is to change over a current value of the electric discharge. Moreover, the pulse length of a current value that is lower in the initial electric discharge stage can be controlled by the control means. As a result, the amount of material which is supplied from the electrode is controlled.

For the above reason, Applicants respectfully submit that the Examiner's fundamental premise in rejecting the current claims is incorrect. Thus, claims 1-3 are not anticipated by, nor suggested by, Magara.

2. The rejection of claims 1-3 under 35 U.S.C. § 103 (a) as being obvious over Magara in view of Graell.

The further reference to Graell is intended to provide an electro-erosion machine which can reduce the wear of the electrode. Garaell merely discloses in Fig. 10 a step-up current impulse diagram which shows different forms of the rising side of the stepped impulse. For example, Graell discloses at column 5, lines 16-24 as follows:

> So what is invented is the power to vary the slope of the rising side (leading edge) of the current impulse step by step, the breadth of each step being a function of the time and the height, and since a function of the current varies each one of these parameters, it is possible to achieve an infinite range of shapes of the rising side of the impulse of working current, thereby giving it the form most suitable for reducing the wear of the electrode to its minimum value.

While the further reference to Graell illustrates the step-up current impulse diagram, Graell does not disclose that a control means for setting the first pulse width and the first peak value so that an electric current density between the electrodes can be in a predetermined range to suppress the emission of electrode material, during a period of the first pulse width a diameter of an electric discharge arc column is extended. Certainly, increasing the electrode erosion at a later time is antithetical to Graell's teachings. Thus, the further reference to Graell does not teach or suggest the deficiencies in Magara. Therefore, it is submitted that the combination of Magara and Graell does not render claims 1 and 2 obvious.

With respect to claim 3, neither Magara nor Graell suggests that the pulse width and the peak value are controlled in a stepwise manner so that emission of the electrode material is suppressed and that the amount of electrode erosion is intentionally increased to promote the appropriate release of coat-formation elements into the gap, following the initial suppression period. Specifically, there is no teaching nor any suggestion in Magara or Graell, taken singly or together, of the steps of "setting the first pulse width and the first peak value so that an electric current density between the electrodes can be in a predetermined range to suppress emission of electrode material" and "setting the first pulse width and the first peak value so that an electric current density between the electrodes can be in a predetermined range to suppress emission of

electrode material" and setting the k-th pulse width and the k-th peak value ($2 \leq k \leq n$, k is an integer) so that an amount of hard coat material supplied to a space between the electrode and the workpiece is increased to a predetermined appropriate quantity for formation of said hard coat" as called for in claim 3.

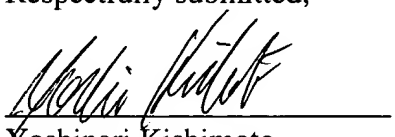
Further, Magara does not teach or suggest the invention. While a step-up current impulse diagram shown in Fig. 16(b) of Magara appears to be similar to that of the present invention, the Magara diagram illustrates a value of current which is allowed to flow from an auxiliary power supply side in a power supply consisting of the auxiliary power supply 10b and a main power supply 10a. In view of this, the intent or purpose of Magara is quite different from that of the present invention where the Applicants have been motivated to solve the problems inherent in electric discharge surface treatment. That is, in order to controllably vary the consumption of an electrode and improve the performance of a coating, the current value is changed. Neither reference teaches or suggests such motivation as mentioned above. Nor is such teaching found when Magara is combined with Garaell.

It should be noted that a technique by which an electric discharge waveform is changed in the electric discharge treatment from the viewpoint of the electrode consumption is disclosed in, for example, U.S. Patent No. 3,974,357. However, there is conventionally no concept that the current waveform should be controlled for the purposes of variably controlling the electrode consumption and increasing the performance of the coating in electric discharge treatment. Therefore, the present invention is patentable over the cited references.

The present Brief on Appeal is being filed in triplicate. Unless a check is submitted herewith for the fee required under 37 C.F.R. §1.192(a) and 1.17(c), please charge said fee to Deposit Account No. 19-4880.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



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Date: November 22, 2002

APPENDIX

CLAIMS 1-3 ON APPEAL:

1. (Amended) An electric power unit for electric discharge surface treatment by which electric discharge is generated between an electrode for electric discharge surface treatment and a workpiece so that a hard coat is formed on a surface of the workpiece, energy of electric discharge, comprising:

a control means for dividing an electric discharge current pulse into a first pulse width with a first peak value, a second pulse width with a second peak value, . . . , and an n-th pulse width with an n-th peak value (n is an integer equal to 2 or more),

wherein the control means sets the first pulse width and the first peak value so that an electric current density between the electrodes can be in a predetermined range to suppress emission of electrode material, and so that during a period of the first pulse width a diameter of an electric discharge arc column is extended, and

the control means sets the k-th pulse width and the k-th peak value ($2 \leq k \leq n$, k is an integer) so that a quantity of supply of hard coat material by the emission of electrode material can be a predetermined value determined according to a predetermined processing condition.

2. (Amended) A method of electric discharge surface treatment for forming a hard coat on a surface of a workpiece by which electric discharge is generated between an electrode for electric discharge surface treatment and the workpiece so that the hard coat is formed on the surface of the workpiece, comprising the steps of:

dividing an electric discharge current pulse into a first pulse width with a first peak value, a second pulse width with a second peak value, . . . , and an n-th pulse width with an n-th peak value (n is an integer equal to 2 and more);

setting the first pulse width and the first peak value so that an electric current density between the electrodes can be in a predetermined range to suppress emission of electrode material, and so that during a period of the first pulse width a diameter of an electric discharge arc column is extended; and

setting the k-th pulse width and the k-th peak value ($2 \leq k \leq n$, k is an integer) so that a quantity of supply of hard coat material by the emission of electrode material can be a predetermined value determined according to a predetermined processing condition.

3. A method of electric discharge surface treatment for forming a hard coat on a surface of a workpiece by which electric discharge is generated between an electrode for electric discharge surface treatment and the workpiece so that the hard coat is formed on the surface of the workpiece, comprising the steps of:

dividing an electric discharge current pulse into a first pulse width with a first peak value, a second pulse width with a second peak value, . . . , and an n-th pulse width with an n-th peak value (n is an integer equal to 2 and more);

setting the first pulse width and the first peak value so that an electric current density between the electrodes can be in a predetermined range to suppress emission of electrode material,

setting the k-th pulse width and the k-th peak value ($2 \leq k \leq n$, k is an integer) so that an amount of hard coat material supplied to a space between the electrode and the workpiece is increased to a predetermined appropriate quantity for formation of said hard coat.

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SUBMISSION OF APPELLANT'S BRIEF ON APPEAL

Commissioner for Patents
Washington, D.C. 20231

Sir:

Submitted herewith please find an original and two copies of Appellant's Brief on Appeal. A check for the statutory fee of $320.00 is attached. The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account. A duplicate copy of this paper is attached.

Respectfully submitted,

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